COLAB

Laboratory for studying Analyst Collaboration

Clayton T. Morrison

Paul R. Cohen

3 December 2004

COLAB

- **GOAL**: provide a laboratory for controlled experiments studying how groups of human analysts can together build interpretations of unfolding situations based on accruing intelligence data.

- COLAB will be used in studies to
  - Identify conditions that promote effective collaboration amongst analysts
  - Identify conditions that affect trust
  - Assess proposed analysis tools

COLAB

Three components:

Hats Simulator - a challenging problem domain involving thousands to millions of agents engaged in individual and collective behaviors, a small portion of which are terrorist

AIID - an instrumented working environment within which analysts collaborate to build their interpretation

COLAB/Trellis Interface - the human interface to COLAB: Trellis hypothesis authoring and management tool, query interface and blackboard browser

The Hats Simulator

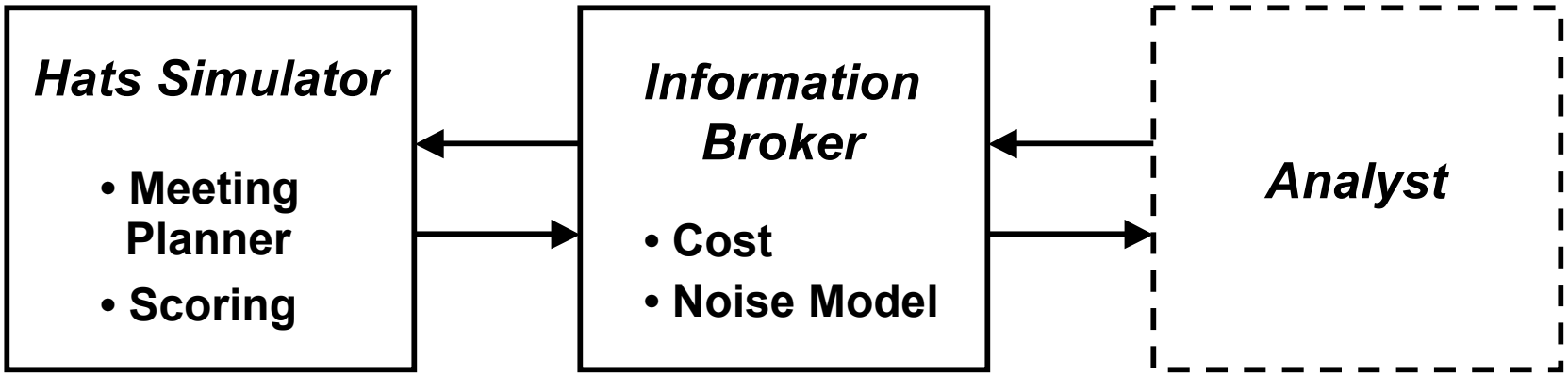
The Hats Problem Domain

Find terrorist task forces in the Hats simulator before they can do harm

- little domain knowledge required
- huge number of hypotheses
- huge amount of temporal data (data feed, events over time)
- very low signal-to-noise ratio

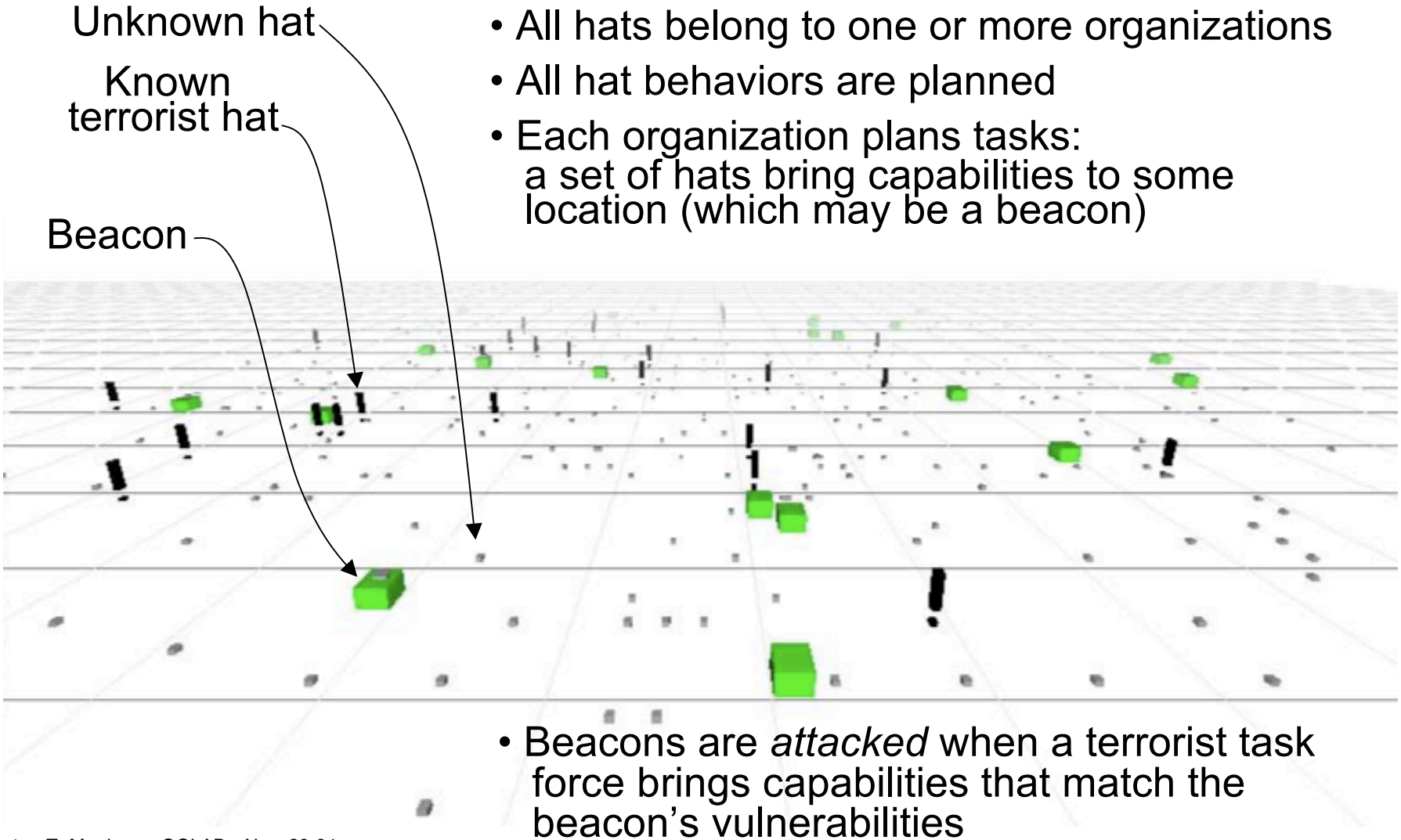
- Characterize the task domain and the sources of power in analyst collaboration and assistive technology

The Hats Simulator Architecture



The Hats Domain

- Hats: Benign, Known Terrorist, Covert Terrorist (benign and covert terrorist hats look alike)
- All hats belong to one or more organizations
- All hat behaviors are planned
- Each organization plans tasks: a set of hats bring capabilities to some location (which may be a beacon)



- Beacons are *attacked* when a terrorist task force brings capabilities that match the beacon's vulnerabilities

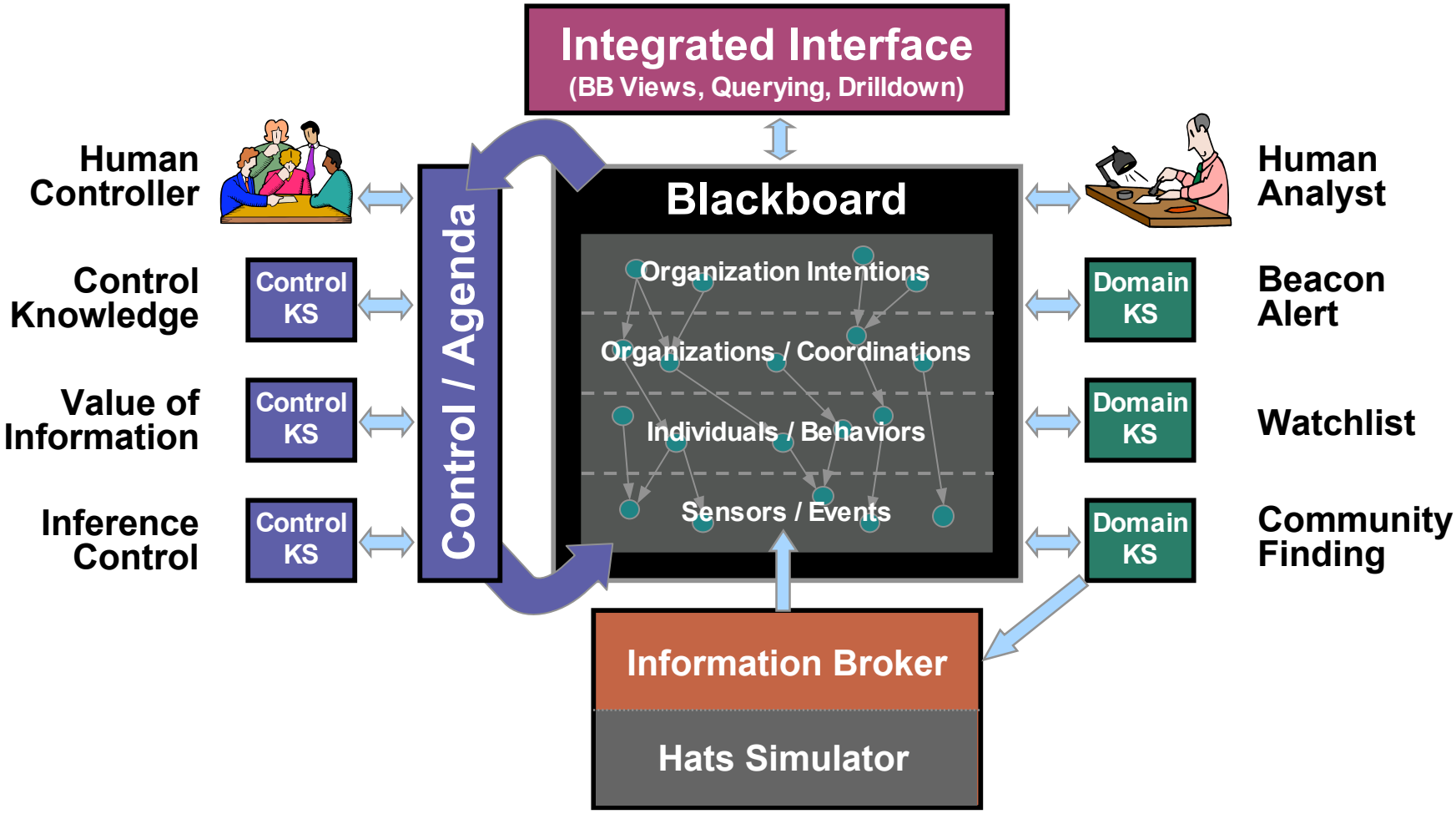
AIID

Architecture for the Interpretation of Intelligence Data

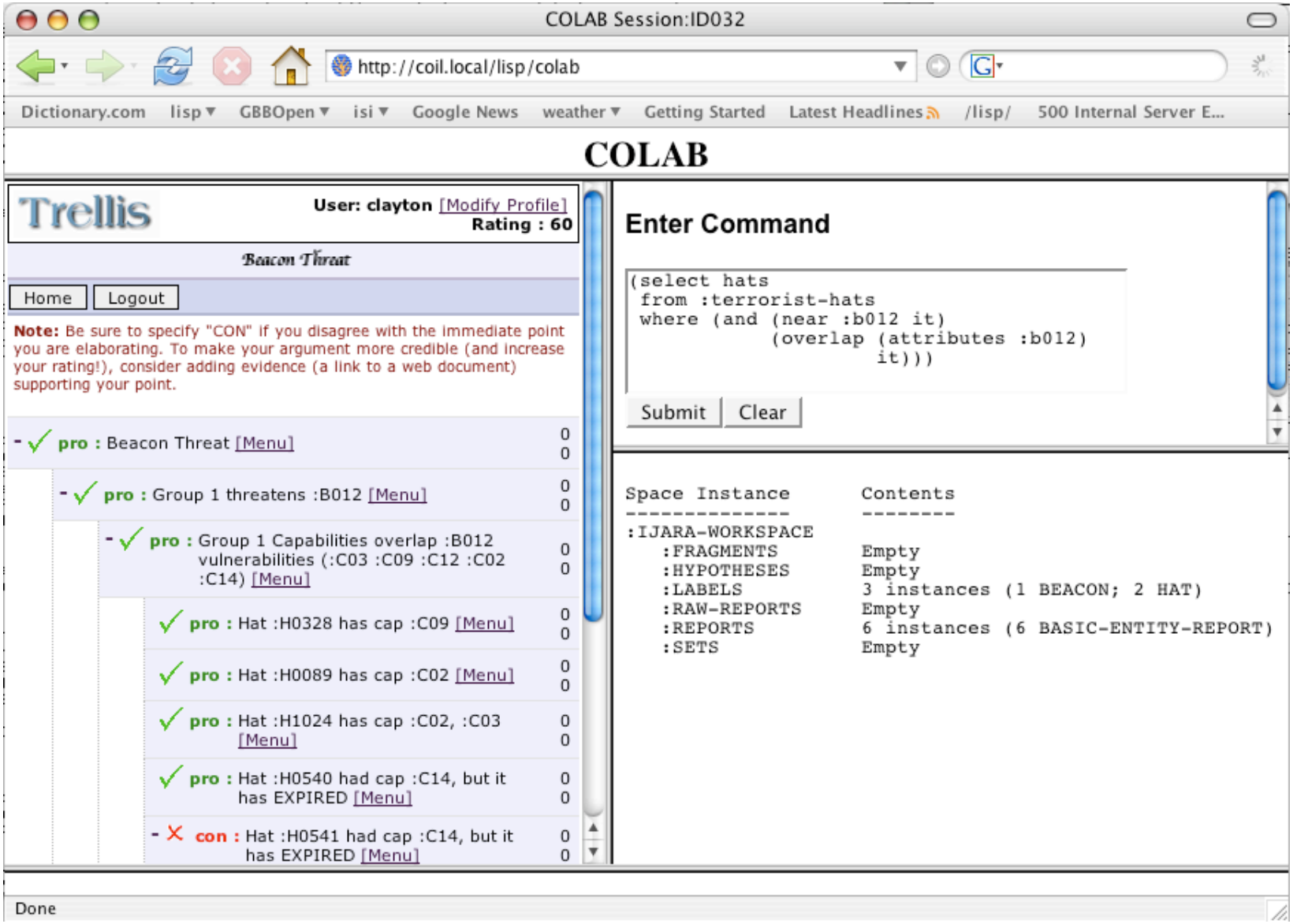
AIID

- Blackboard Systems
  - Handle *large* amounts of *asynchronous*, *noisy* data
  - Geared to interpretation
    knowledge-driven, top-down *and* bottom-up
  - Incremental and opportunistic construction
  - Multiple sources of evidence
- Bayesian Belief Networks
  - Principled way of handling uncertainty
  - Combining probabilistic evidence
- Additionally, the AIID system provides:
  - Corporate memory
  - Drilldown

AIID

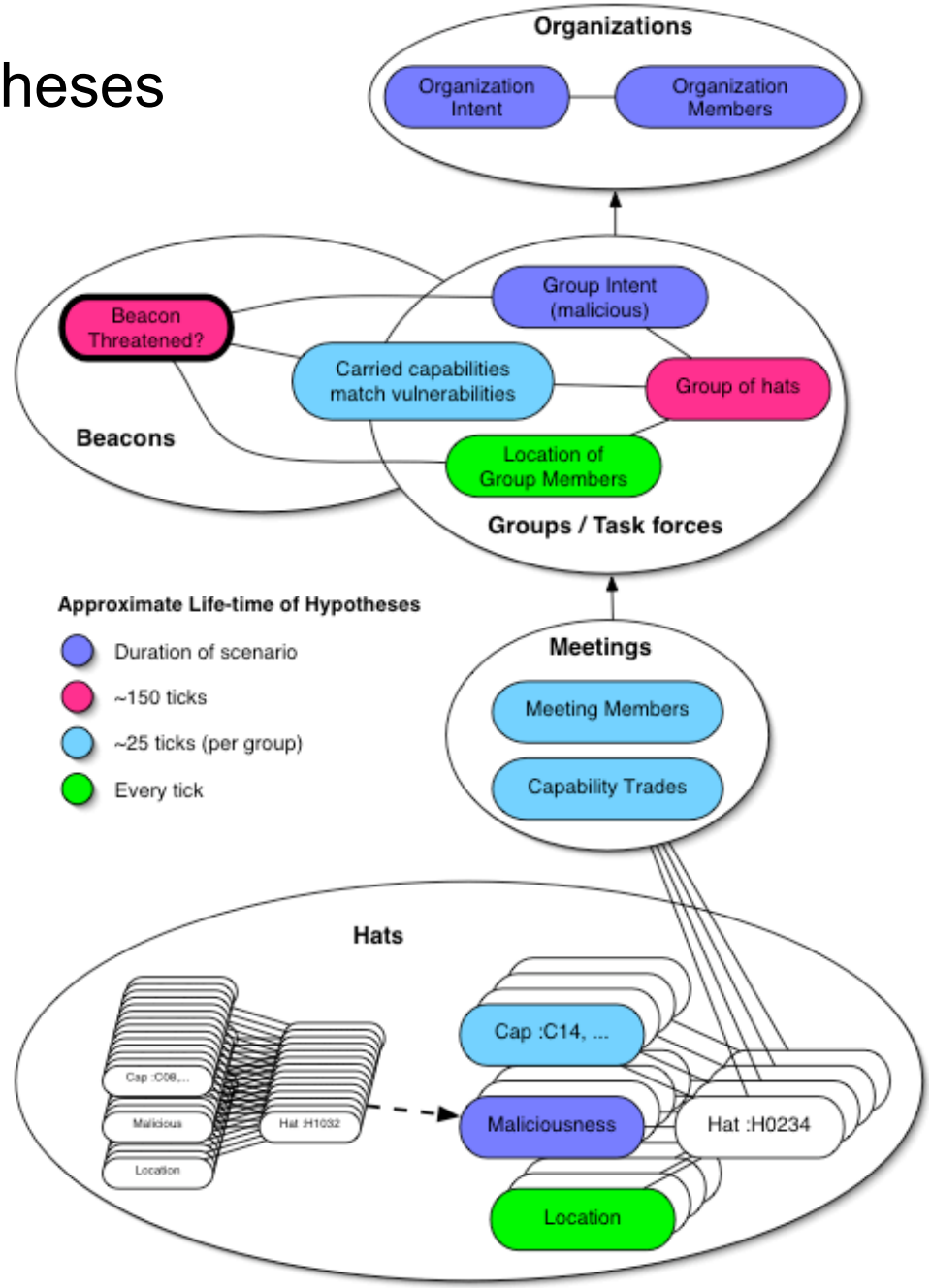

Integrated Interface
(BB Views, Querying, Drilldown)
Human Controller
Control Knowledge
Value of Information
Inference Control
Control KS
Control KS
Control KS
Control / Agenda
Blackboard
Organization Intentions
Organizations / Coordinations
Individuals / Behaviors
Sensors / Events
Domain KS
Domain KS
Domain KS
Human Analyst
Beacon Alert
Watchlist
Community Finding
Information Broker
Hats Simulator

COLAB/Trellis Interface


COLAB Session:ID032
http://coil.local/lisp/colab
Dictionary.com lisp GBBOpen isi Google News weather Getting Started Latest Headlines /lisp/ 500 Internal Server E...
COLAB
Trellis
User: clayton [Modify Profile]
Rating : 60
Beacon Threat
Home
Logout
Note: Be sure to specify "CON" if you disagree with the immediate point you are elaborating. To make your argument more credible (and increase your rating!), consider adding evidence (a link to a web document) supporting your point.
pro : Beacon Threat [Menu]
pro : Group 1 threatens :B012 [Menu]
pro : Group 1 Capabilities overlap :B012 vulnerabilities (:C03 :C09 :C12 :C02 :C14) [Menu]
pro : Hat :H0328 has cap :C09 [Menu]
pro : Hat :H0089 has cap :C02 [Menu]
pro : Hat :H1024 has cap :C02, :C03 [Menu]
pro : Hat :H0540 had cap :C14, but it has EXPIRED [Menu]
con : Hat :H0541 had cap :C14, but it has EXPIRED [Menu]
Enter Command
(select hats
from :terrorist-hats
where (and (near :b012 it)
(overlap (attributes :b012)
it)))
Submit
Clear
Space Instance Contents
:IJARA-WORKSPACE
:FRAGMENTS Empty
:HYPOTHESES Empty
:LABELS 3 instances (1 BEACON; 2 HAT)
:RAW-REPORTS Empty
:REPORTS 6 instances (6 BASIC-ENTITY-REPORT)
:SETS Empty
Done

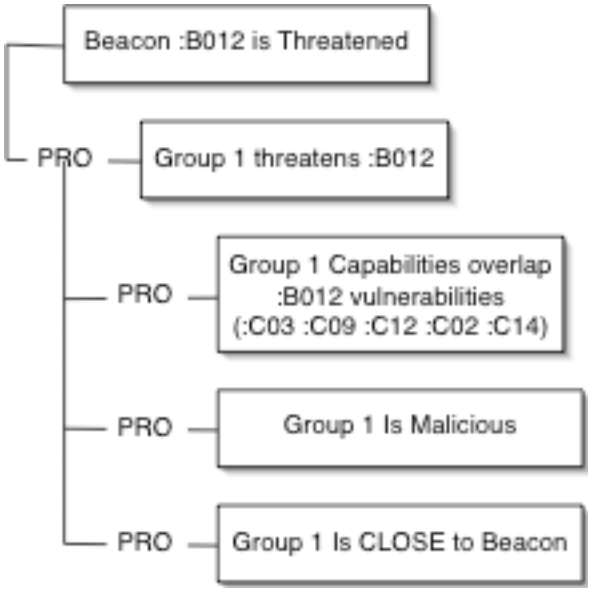
Player Hypotheses

- Kinds of hypotheses
- Different time scales
- Relations between hypotheses

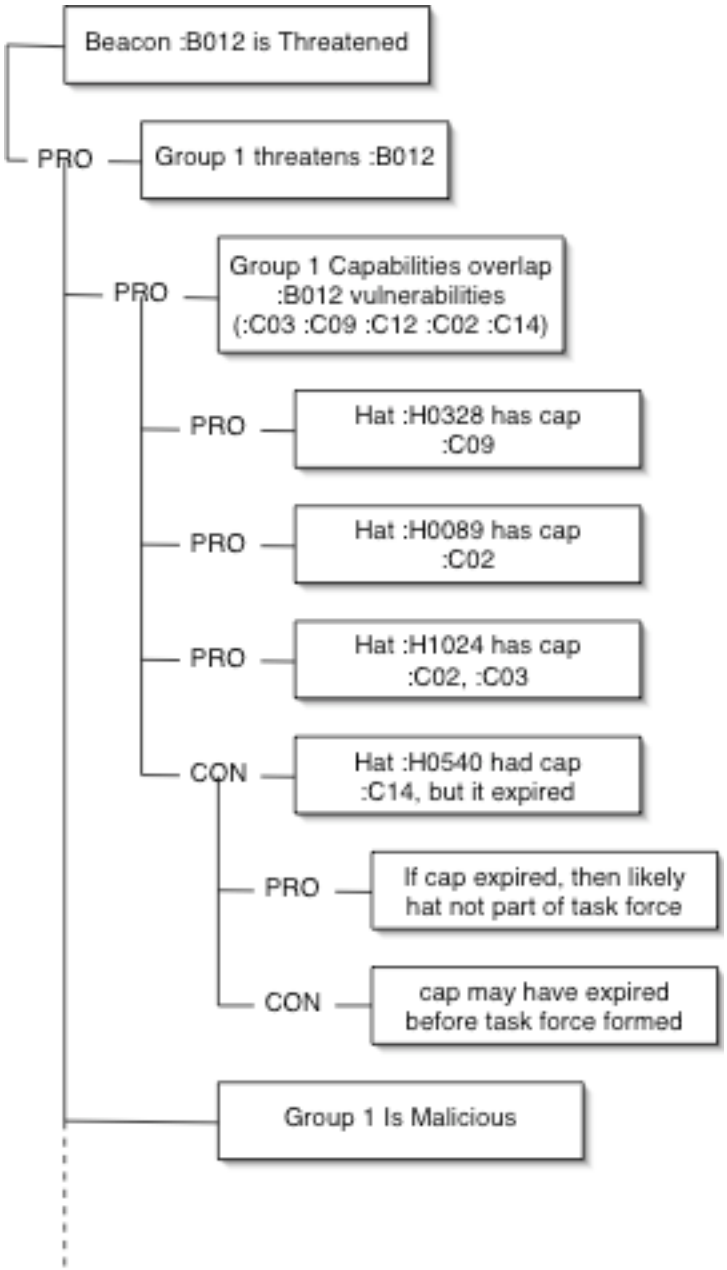


Trellis-authored Hypotheses

- Using Trellis to structure relationships between propositions



- Expanding hypotheses



Trellis-authored Hypotheses

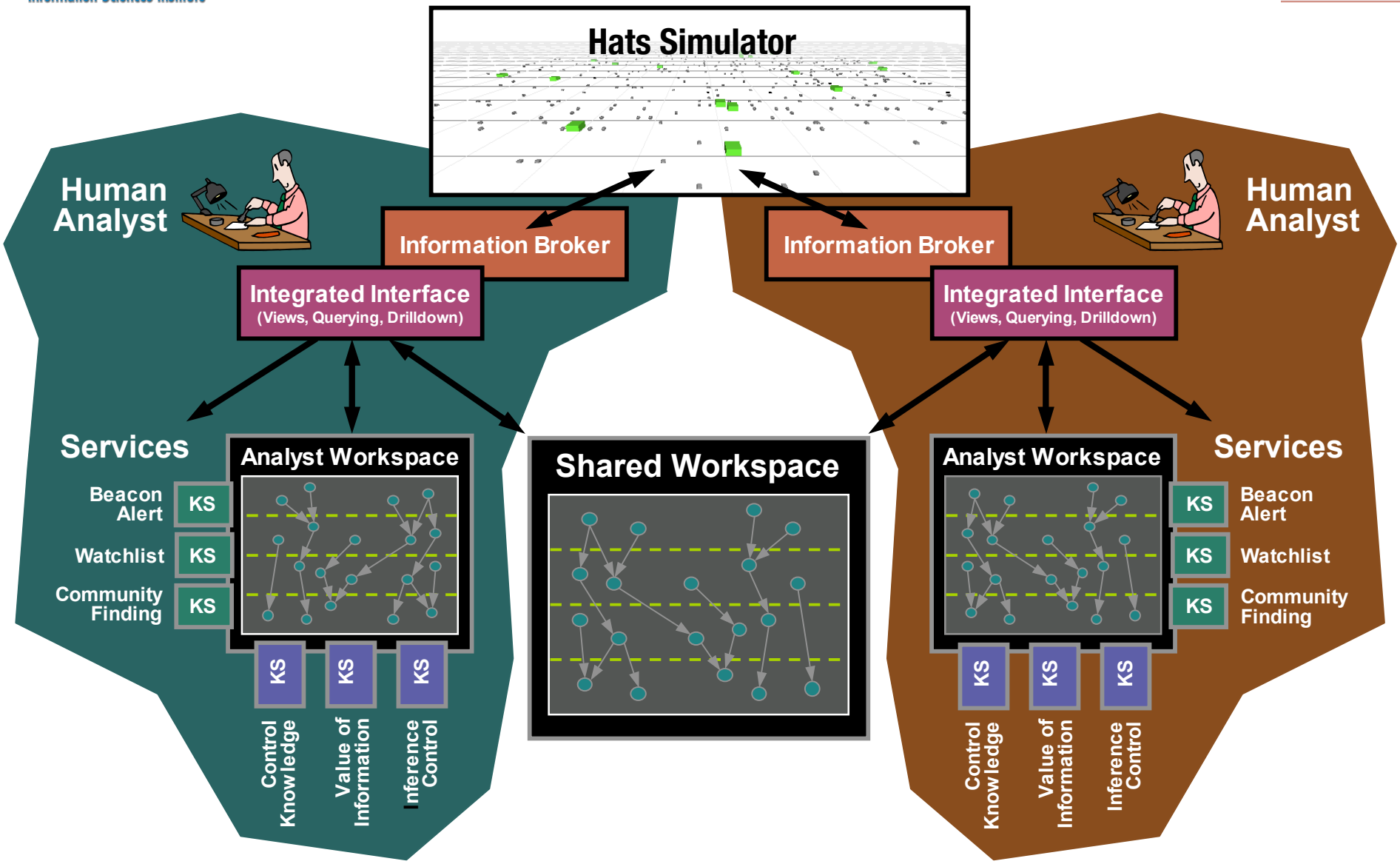
- Trellis table representation
  - facilitates quick, informative comparison

	Capability Overlap	Suspicion	Proximity to Beacon
Group 1 Threatens Beacon :B012	Overlaps 3/4 Capabilities	Very Suspicious	Near
Group 2 Threatens Beacon :B012	Overlaps 1/5 Capabilities	Moderate Suspicion	Far
Group 3 Threatens Beacon :B012	Overlaps 7/8 Capabilities	Not Suspicious	Far


ISI
Information Sciences Institute


USC
SCHOOL OF
ENGINEERING

COLAB


Hats Simulator
Human Analyst
Information Broker
Integrated Interface
(Views, Querying, Drilldown)
Services
Analyst Workspace
Beacon Alert
Watchlist
Community Finding
KS
Control Knowledge
Value of Information
Inference Control
Shared Workspace
Human Analyst
Information Broker
Integrated Interface
(Views, Querying, Drilldown)
Analyst Workspace
Services
Beacon Alert
Watchlist
Community Finding
Control Knowledge
Value of Information
Inference Control

Progress Report

- Decisions made
  - Trellis as first hypothesis representation (authoring, management)
  - Web-based interface (future multi-user, open platform)
- Progress
  - Basic lisp-based webserver
  - Developed query language (blackboard object database mapped to relational query framework)
  - Initial integration of blackboard with Hats Information Broker (manual posting reports of Hats events)

Plans

- Plans up to March 15
  - Trellis & COLAB initial integration and testing (end of Jan)
  - Refinement of interface and query language - including posting simple alerts (over Feb)
  - Test system with new user (mid Feb)
  - Report for ICCRTS conference (March 15)
- Post March 15 Plans
  - Extension to multi-player
  - Instrumentation
  - KS Toolkit

Open Challenges

- Visualization and access to information
  - How do we visually present enormous data usefully?
- Hypothesis representation
  - Representing uncertainty (Bayesian approaches? But how to we make Bayesian inference intuitive?)
  - How do we flexibly and meaningfully represent analyst's hypotheses
  - How are these hypotheses best communicated, shared and collaboratively authored?
- What are the key variables for promoting successful collaboration?
- How can COLAB help answer these questions?